

## New exposure biomarkers enhance breast cancer research

By Kimberly Cannady

Researchers from the Silent Spring Institute in Newton, Massachusetts, which is funded in part by NIEHS, published a study that is the first to comprehensively examine chemicals linked to breast cancer risk and recommend methods for their detection. The [study](http://www.ncbi.nlm.nih.gov/pubmed/24818537) (<http://www.ncbi.nlm.nih.gov/pubmed/24818537>) was published in the May issue of the journal *Environmental Health Perspectives*.

Scientists examined chemical carcinogenicity studies in rodents, to extend the scope of breast cancer epidemiology in humans. According to the study authors, the limited understanding of the biological pathways involved in breast cancer development has impeded the ability of scientists to anticipate which chemicals may increase risk. The use of animal studies provides a basis for anticipating the effects of these chemicals in humans.

"The study provides a road map for breast cancer prevention by identifying high-priority chemicals that women are most commonly exposed to and demonstrates how to measure exposure," said lead author [Ruthann Rudel](http://www.silentspring.org/about-us/staff#ruthann), (<http://www.silentspring.org/about-us/staff#ruthann>) director of research at the Silent Spring Institute. "This information will guide efforts to reduce exposure to chemicals linked to breast cancer and help researchers study how women are being affected."

### Chemical selection and methods to measure exposure

Previously, Rudel and colleagues identified 216 chemicals as potential breast cancer carcinogens, because they caused cancer in rodent studies. After a systematic review of chemical use, exposure, and toxicology data, they narrowed the list down to 102 mammary carcinogens that have high occupational exposure rates, are produced in high volumes, or are present in food, polluted air, and consumer products.

Seventy-five of them fell into 17 groups, based on common exposure potential or structural similarity. These chemicals are found in gasoline fumes, cigarette smoke, diesel exhaust, polyurethane foams and sealants, flame retardants, nonstick and stain-resistant coatings, paint removers, and byproducts of drinking water disinfection.

"Every woman in America has been exposed to chemicals that may increase her risk of getting breast cancer," said co-author [Julia Brody, Ph.D.](http://www.silentspring.org/about-us/staff#julia), (<http://www.silentspring.org/about-us/staff#julia>) executive director of the Silent Spring Institute.

In addition to compiling a list of potential human breast carcinogens, the researchers recommended methods used to measure the presence of these chemicals, termed exposure biomarkers, in women, based on experimental evidence. These include measuring the presence of the parent compound in blood, the metabolite in urine, and DNA and protein adducts, which are interactions of the parent or metabolite with the proteins or DNA.

### Translating animal studies to human models

To demonstrate the relevance of rodent studies to humans, Rudel and colleagues also compared evidence in rodents and humans, for those agents that have been reasonably well-studied in humans. "It is biologically plausible that agents for which there is sufficient evidence of carcinogenicity in experimental animals also present a carcinogenic hazard to humans," according to the International Agency for Research on Cancer in a Silent Spring Institute [press release](http://www.silentspring.org/news/press_releases/scientists-identify-highest-priority-toxic-chemicals-target-breast-cancer-preven). ([http://www.silentspring.org/news/press\\_releases/scientists-identify-highest-priority-toxic-chemicals-target-breast-cancer-preven](http://www.silentspring.org/news/press_releases/scientists-identify-highest-priority-toxic-chemicals-target-breast-cancer-preven))

The new study also identified 44 cohort studies, with a total of more than 3.5 million women enrolled, that have recorded breast cancer incidence and stored blood or urine samples. These additional biomarker measurements can be incorporated into the current study to further evaluate breast cancer risk associated with chemical exposures.



*Rudel leads the exposure and toxicology research programs at the Silent Spring Institute. (Photo courtesy of Jessica Helm)*



*Brody's research is focused on the effects of the environment on breast cancer. (Photo courtesy of Dan Brody)*

Dale Sandler, Ph.D., chief of the NIEHS [Epidemiology Branch](#), believes this study will be of great use. "This paper is a thorough review of toxicology data and biomarkers relevant to breast cancer in humans," Sandler said. "It is a terrific resource for epidemiologists thinking about studying environmental contributors to breast cancer."

*Citation:* Rudel RA, Ackerman JM, Attfield KR, Brody JG.

(<http://www.ncbi.nlm.nih.gov/pubmed/24818537>)

2014. New exposure biomarkers as tools for breast cancer epidemiology, biomonitoring, and prevention: a systematic approach based on animal evidence. *Environ Health Perspect*; doi:10.1289/ehp.1307455 [Online 12 May 2014].

(Kimberly Cannady, Ph.D., is an Intramural Research Training Award fellow in the NIEHS Chromatin and Gene Expression Group.)

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